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instruction where a large number of pupils are brought together. One of the greatest is, that the instructers cannot be sufficiently intimate with the pupils. Whether this evil is remedied by the proposal to have one person entirely devoted to the moral character of the pupils, as is proposed by our author, seems to us a little questionable. One person cannot obtain an intimate knowledge of the character of a hundred young ladies at the same time. Besides, is there not danger that, by making morals the peculiar charge of one instructer, all the rest may become forgetful of their responsibility for the good character and conduct of their pupils?

We would not, however, have it thought that we disagree with our author as to the importance of a greater attention to moral culture in all places of education. On the contrary, there is much reason to fear, that the formation of the moral character is too often lost sight of by instructers. Not that this object is not understood, or that it has not been duly considered in treatises on education, or even that all teachers are insensible to its importance; but merely that, in many schools, academies, and colleges, as commonly conducted, the cultivation of the moral powers and feelings is not made so constant and direct an object of attention as it should be, and as we trust it will become in the gradual progress of improvement.

ART. IV.—*Elements of Technology, taken chiefly from a Course of Lectures delivered at Cambridge, on the Application of the Sciences to the Useful Arts. Now published for the Use of Seminaries and Students.* By JACOB BIGELOW, M. D., Professor of Materia Medica, and late Rumford Professor in Harvard University; Corresponding Secretary of the American Academy of Arts and Sciences; Member of the American Philosophical Society; of the Linnæan Societies of London and Paris, &c. Boston. Hilliard, Gray, & Co. 8vo. pp. 507. 1829.

THE word Technology gives but an imperfect idea of the contents of this volume. The end of a name would have been better answered by some title showing, that it treated of the scientific and practical principles of many of the useful, curious, and elegant arts. All the arts may safely be called useful; it would be difficult to bring one to mind, which has not been, or might not be, made to 'promote the benefit of society,' and all probably owe their remote origin to that necessity which has so long been recognised as the mother of inventions. But what are the elegant arts, if not some of those treated of in this volume, Architecture, Painting, Sculpture, Engraving? And what objects of Art are more curious than the Steam Engine, the Hydrostatic Press, the beautiful exhibition of mechanical contrivance called a Governor, checking or hastening, almost of itself, the too rapid or too tardy action of water or of steam; the Hydraulic Ram of Mongolfier, creating a perennial fountain by the simple passage of the current of an open river through a tube; or the machine called Barker's Mill, in which, without wheels or flume, corn is ground by the reacting force of a stream of water spouting against the empty air?

Everything however, in the volume, has a practical tendency, and is suited to fulfil the intentions of the founder of the Rumford Professorship, from the chair of which the lectures of Dr Bigelow were delivered.

'A certain degree of acquaintance with the theory and scientific principles of the common arts, is found so generally important, that most educated men, in the course of an ordinary practical life, are obliged to obtain it from some source, or to suffer inconvenience for the want of it. He who builds a house, or buys an estate, if he would avoid disappointment and loss, must know something of the arts which render them appropriate and tenantable. He who travels abroad to instruct himself, or enlighten his countrymen, finds in the works of art the most commanding objects of his attention and interest. He who remains at home, and limits his ambition to the more humble object of keeping his apartment warm, and himself comfortable, can only succeed through the instrumentality of the arts.

'There has probably never been an age in which the practical applications of science have employed so large a portion of the talent and enterprise of the community, as in the present; nor one in which their cultivation has yielded such abundant rewards. And it is not the least of the distinctions of our own country, to have contributed to the advancement of this branch of improvement, by many splendid instances of inventive genius, and successful perseverance.

'The importance of the subject, and the prevailing interest which exists, in regard to the arts and their practical influences, appear to me to have created a want, not yet provided for, in our courses of elementary education. Information on these subjects is scattered through the larger works on mechanics, on chemistry, mineralogy, engineering, architecture, domestic economy, the fine arts, &c., so that it rarely happens, that a student in any of our colleges gathers information enough to understand the common technical terms which he meets with in a modern book of travels, or periodical work. It is only by making the elements of the arts themselves subjects of direct attention, that this deficiency is likely to be supplied.' pp. iii, iv.

Such are the purposes for which the lectures were originally written, and for which the substance of them is now given to the public. Probably few young men, during the last twenty years, have come out from their courses of study at college into the business and interests of the world, without feeling more or less of the want, of which Dr Bigelow speaks. The great end of a rightly conducted education is, to bring out and give the complete exercise of one's faculties ; and so long as the possession of a clear judgment, a quick apprehension, a fine taste, a correct mode of reasoning, and the right and ready use of language shall continue to be desirable, something like the system now pursued at our highest places of education will undoubtedly be continued.

But these are not enough. There is this great want to be supplied. The young graduate finds the conversation of people in society occupied with subjects that are new to him, on which he feels, notwithstanding, that he is expected to be better informed than others. He has long had his best thoughts absorbed with the principles of science ; he is eagerly looking round for their applications. In considering the connexion he is to have with the productive classes of society, he sees how important it is to him, in whatever relation he is to stand to them, to have some knowledge of their pursuits. He is surrounded by the products of the arts ; his necessities are supplied, his taste is gratified by them ; he wishes to understand how the raw productions of nature have been so skilfully and beautifully converted into the fabrics which minister to his use and convenience, and give such facilities to his advancement. What are the combinations of machinery, which have, in a few years, in the manufacture of cotton, woollen, and iron, increased the productive labor of a great nation in a twofold or threefold degree ? What are the modifications in the application of steam, which are so changing the face and condition of parts of our own country and of others, opening new regions to the light of society and commerce, and bringing near each other the inhabitants of distant climates? What are the inventions to which he hears such frequent reference, as proving the great superiority of the age, and which have exercised, and brought forward to public view, the genius of Watt and Fulton, Arkwright and Perkins?

He has curiosity of a higher kind. He has not drawn so long from the Greek and Roman fountains, without imbibing an undefined reverence for the hitherto unseen and almost unimagined excellence of creative art in painting, architecture, and sculpture. What are these charming arts of Greece and Italy, which the highest and noblest have admired most? What were the slow advances, what the coincidence of sagacity and fortune, urged by what necessity, or what inspiration, has Grecian skill converted the log hut of the savage Pelasgian into the temple of Virgin Athené or of Olympian Jupiter? What is the art by which Phidias could so give the form of life to marble,

'Che non sembiava imagine che tace'?

To gratify, and still more to excite this curiosity, and to supply this want, are the tendency and object of the Elements of Technology. Such have undoubtedly been the effects of Dr Bigelow's lectures, and many will recollect with what interest and advantage they were heard. As a textbook, this work is likely to be still more useful. It may offer the occasion, as it gives the means, of forming, in many places of education, a new department or a new study, as important undoubtedly, and capable of being rendered as attractive, as any study or department whatever.

The object of such a department would be the application of the principles of philosophy to the arts and pursuits of men. And philosophy should be here understood in its most extensive sense, as comprehending, not only what has been fixed by the principles of science, but what has been discovered by experience and observation, or brought accidentally to light, in whatever concerns the external accommodation of the solitary or social man, facilitates his intercourse immediately or remotely with his species, gives him power over the elements and the productions of the earth, or enables him to extend his inquiries above or below him, and to penetrate into the hidden parts of the creation. Such a department, or course of instruction, should not take the place of any other now existing, but should be superadded, as the key-stone of the arch, to give completeness and solidity to the fabric of education.

At the end of an elaborate, but somewhat flattering, comparative estimate of the character of the arts of ancient and modern times, we have the author's opinion of the value of the study we are recommending, which we are glad to bring forward in support of the view we have taken.

> ' Let any one, who would know what modern arts have accomplished, compare the repeating watch, and the unerring chronometer of the present day, with the rude sun-dial and clepsydra of the ancients. Let him consider the multiplied advantages which attend the invention of glass, which has enabled us to combine light with warmth in our houses; which has given sight to the aged, which has opened the heavens to the astronomer, and the wonders of microscopic life to the naturalist. Let him attend to the complicated engines and machinery, which are now introduced into almost every manufacturing process, and which render the physical laws of inert matter, a substitute for human strength.
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> ' But it is not the contrast with antiquity alone, that enables us to appreciate the benefits which modern arts confer. In the present inventive age, even short periods of time bring with them momentous changes. Every generation takes up the march of improvement, where its predecessors had stopped, and every generation leaves to its successors an increased circle of advantages and acquisitions. Within the memory of many who are now upon the stage, new arts have sprung up, and practical inventions, with dependent sciences; bringing with them consequences which have diverted the industry, and changed the aspect of civilized countries. The augmented means of public comfort and of individual luxury, the expense abridged, and the labor superseded, have been such, that we could not return to the state of knowledge which existed even fifty or sixty years ago, without suffering both intellectual and physical degradation. At that time philosophy was far distant from its present mature state, and the arts which minister to national wealth were in comparative infancy. No man then knew the composition of the atmosphere, or of the ocean. The beautiful and intricate machinery, which weaves the fabric of our clothing, was not even in existence. When George the Third visited the works of Messrs Boulton and Watt at Birmingham, and was told that they were manufacturing an article of which kings were fond, and that that article was power; he was struck with the force and disadvan-

tageousness of the comparison. Yet the steam-engine had not then been launched upon the ocean, and had developed only half its energies.

'So long as the arts continue to exert the influence, and to yield the rewards, which they have hitherto done, there will be no want of competent minds and hands, to carry forward their advancement. With their increasing consequence, there must also be an increasing attention to their study and dissemination. Curiosity keeps pace with the interest and magnitude of its objects. And unless the character of the present age is greatly mistaken, the time may be anticipated as near, when a knowledge of the elements and language of the arts will be as essentially requisite to a good education, as the existence of the same arts is to the present elevated condition of society.' pp. 5, 6.

Dr Bigelow's book is well suited to be the foundation of a course of instruction in this study. It is not, as might, from looking over its contents, be thought, a superficial work, gleaned hastily from books of science, and treatises on the arts, but evidently the fruit of much study and research, carried on for ten years, with the leading view of collecting, on the subjects which it embraces, what is best ascertained and of most important practical bearing. Except in the introduction, the author, throughout the work, confines himself to giving the clearest and most satisfactory account possible of the object he is describing, and he must often, one would think, have exercised great self-denial in avoiding all speculation, when most inviting, and all subjects of associated interest. His descriptions are very much condensed; sometimes, perhaps, too much so. An indolent or superficial reader would be likely to consider this a defect. For the purpose of a text-book it is an excellence, as it increases, without obscurity, the mass of materials far beyond what could have been presented, by a different mode, within the same compass.

It is strictly what it professes to be; and one who should take it as the basis of instruction in the subjects of which it treats, having thus furnished to his hand all the essential materials for his lectures, all that requires the greatest research to collect and the most care to arrange and express, might give his undivided attention to those less important but often more interesting particulars, of a historical, discursive, or speculative nature, which might be employed to introduce and recommend the solid utility of the substance of the book.

The first chapter is upon the materials used in the arts, taken from the mineral, vegetable, and animal kingdoms. To make it interesting as it might be made, access should be open to a cabinet richly stored with the spoils of the ocean and the land, from the bone that lines the mouth of the whale, to the horn of the wild ox* of Brazil, or the buffalo of Missouri, and the tusk of the elephant; the soft skin and hair of the goat of Cashmere, and fur from the northern lakes; specimens of each variety of wood, or stone, or metal, of ornament or use, whether growing in our native forests, or taken from the quarries beneath them, or brought from the shores and mines of distant countries;

> 'Oro ed argento fino, e cocco, e biacca,
> Indico legno lucido e sereno,
> Fresco smeraldo.'

In describing them, it would be more difficult to avoid, than to select valuable and curious facts in natural history to enliven the details.

The second chapter treats of the form, condition, and strength of materials, and begins, as do most of the chapters, with exact definitions of the language to be employed. Among the authorities referred to at the end of the chapter, we miss an illustrious name. The first treatise upon this most remarkable and useful branch of mechanics was written by Galileo, with an elegance and simplicity which make his works the delight of the scholar, as they are and always have been the pride of his countrymen. His original treatise contains the clearest elementary views that have, perhaps, at any time been given; and the best illustrations are still drawn from the same source.

Let it not be thought, that the name of Galileo is irrelevant, when we are speaking of a subject which owes its origin, the best of its methods, and the most beautiful of its illustrations, to the unacknowledged ingenuity and patience of this great man.

Chapter third is upon the arts of writing and printing. The first section, upon the modes of transmitting knowledge before the invention of letters, ends with the following observations.

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* Not less than seven distant places in South America send to the comb-makers in New England contributions of horns from the great herd of wild cattle, that roam the interminable plains from Patagonia to the bay of Honduras, and a practised eye distinguishes by the twist of the horn the region from which each came.

'The founders of the Pyramids have not been able to convey to us their names, and the productions of the earliest sages and poets can never be appreciated from acquaintance. The symbolic sculptures, which cover the antiquities of Egypt, are now subjects of empty speculation to the curious. History must have remained uncertain and fabulous, and science been left in perpetual infancy, had it not been for the invention of written characters.' p. 53.

If the portion upon the invention of letters had been written a few months after the time at which, as we understand, it was sent to the press, the author would doubtless have caught some hints from the investigations of Champollion and the other publications upon the subject of Egyptian hieroglyphics, in regard to this invention, and might have been led to consider the 'symbolic sculptures' as subjects of something more than 'empty speculation.' The only purpose for which we now refer to these very curious discoveries, is to notice the light, which the mode pursued in deciphering the hieroglyphics has thrown upon the hitherto dark path, by which the human mind was led on to the invention of letters.

This most important of inventions may well be, as it has been, considered the most ingenious or most fortunate that has ever been made by the human mind. If we could trace it, in its several steps, we should probably find that the first hint was suggested by necessity or furnished by accident, that this was gradually wrought upon by patient and sagacious thought, and carried out to its perfection by that divine instinct of fine minds, which forbids their resting satisfied with what is faulty or incomplete.

After the obvious invention of picture-writing, or the representation of visible objects by delineating their figures, and the higher and more difficult invention of hieroglyphics, representing ideas or abstract qualities by the figures of objects having a real or supposed resemblance to them, it became necessary, on the monumental structures of the Egyptians, to represent the names of individuals. When a name was significant, as are most proper names among rude nations, it would be an obvious device to delineate the figure of the object, of which the name was significant, with some mark to show that it was not to be understood symbolically. Thus, the figure of a wolf or a cross, sculptured upon the stone, would call to mind an individual who had borne one of these names.

Compound names of the same kind, such as *wood-house*, *Horne-man*, *Dart-mouth*, would present no greater difficulty; and in a language almost entirely made up of monosyllables, as the ancient language of Egypt is said to have been, nearly all the syllables were probably significative, and the syllables of most frequent occurrence significative of the most common visible objects. In such a language it would not be difficult to represent to the eye such a word as *Spi-ne-to*, by objects which should immediately recall the sounds of which it is composed.

This mode once adopted with significant names, or names made up of significant syllables, would be easily extended to those of different structure. Where it was found impossible exactly to hit the sound, an approximation might be made to it. In most cases, the sound of only a single syllable, or a single letter, would be indicated by a single figure, to a people speaking a language nearly monosyllabic. Where an object suggested more than one simple sound, choice or necessity might lead to consider it as representing only the initial sound. The figure of a *pen*, a *seal*, or a *vase*, would thus suggest only the sound of *p*, of *s*, or of *v*; and the figures of a *hand*, a *ring*, the *mouth*, and a *seal*, would express the name *Hermes*. The vowel-sounds need not be expressed, as they are omitted, to this day, in several of the oriental languages.

The Egyptian would thus have been furnished with the means of expressing any proper name in characters significant of sounds only; and it is precisely in this way, that the names of *Ptolomæus* and *Cleopatra* are found expressed on the famous Rosetta Stone, which has acted so important a part in so far solving the riddle of Egyptian hieroglyphics.

It would apparently not require a great stretch of sagacity to discover, that the figures which had been employed to express the sounds of which proper names are composed, might be applied to the expression of the sounds of all other words, and we are thus furnished with an alphabet of letters, made up of the figures of the most common visible objects. The difficulty and trouble of representing these accurately would gradually lead to the use of the outline of figures, instead of the figures themselves, or a part for the whole, so that at length only a rude resemblance would remain to the form of the original object.

The figures and names of the Hebrew letters are such as they would have been, if invented in the way we have here supposed. A resemblance, more or less distant, to the whole or a part of such objects as the bull, a house, a camel, a door, is still to be traced in these letters, and is said to be still more striking in those of the more ancient Phœnician alphabet. The Phœnicians, according to Mr Astle, as quoted by Dr Bigelow, are thought to have the best claims to be considered the inventers of letters; and it is in their alphabet, that we most clearly perceive indications of their having been invented in the way we have endeavored to trace.

From the invention of letters, Dr Bigelow proceeds to the materials used, at different periods, in writing, and to whatever is most curious in the arts of printing and stereotyping, as they are now practised. Probably no part of the volume will be so new to the greater number of readers as this chapter. The concluding remarks are curious, as showing how near an approach had, more then once, been made to the art of printing, previous to its invention.

'Although printing with moveable types is exclusively a modern art, yet there are some steps in the discovery, which have claim to greater antiquity. The Chinese have printed with their characters for more than nine hundred years, but as the nature of this character requires that much should be expressed by a single figure, they are obliged to cut each character with all its complications in a block of wood, so that their method resembles a limited kind of stereotype printing.

'Among the relics of ancient Rome, there have been found letters cut in brass and raised above the surface exactly like our printing types. Some of these contain the names of individuals, and from their shape and appendages, were evidently used for the purpose of signature, the letters being small, smooth, and even, while the ground beneath them is unequal, and rough, so that they must have been employed, not for impressions into soft substances, but for printing with colored liquids, on a surface like parchment or paper. Had the individuals, whose names were thus printed, been visited with the thought, that, by separating the letters, they might print the name of another, it is probable that the art would have been at once discovered, and that the dark ages might never have happened.' pp. 69, 70.

To illustrate skilfully the chapter upon designing and painting, would require the knowledge and taste of a painter. With a few engravings, however, and a few pictures, the subject might be made perfectly plain and interesting. Without such illustration, and the instruments referred to or described in this chapter, it is not venturing much to say, that by most persons the observations on perspective would not be understood. This is true of only a small part of the chapter. The greater portion of it, and the whole of the next two chapters, on engraving and lithography, and on sculpture, modelling, and casting, are in the highest degree interesting, and perfectly intelligible. It is needless to remark, how much a collection of good engravings in the different styles here described, a specimen or two of the metal plates engraved, of the stone and other materials used in lithography, of casts and *bas reliefs*, in plaster and in bronze, and a few engraved gems, cameos and intaglios, and mosaics, would add to the impression made on the mind of the learner.

But the most interesting and satisfactory portion of the volume, both from its subject and the full and successful manner in which it is treated, is the chapter upon architecture and building. The history of architecture and sculpture, if it could be fully written, would be the history of many of the noblest exertions of the human mind, from its first asserting its nature in the most remote antiquity, in the happiest and most flourishing periods of the great empires, and in their decline, through that period, which, with this history, might cease to be considered dark, down to the present day. It would trace these arts from their original caves among the troglodytes of ancient Ethiopia, the present country of the Abyssinians and Nubians, distinguished even in that remote age by traits of feature and form which we are wont to regard with pity or contempt as the marks of an inferior nature.

As far as can be learnt from the earliest and most authentic remains of art and tradition, dark-colored men, with flat faces and limbs not so straight as ours, were the first cultivators of the infant art. They dwelt in lime-stone caves in the hill country about the sources or between the branches of the Nile. Emerging, at whatever period, from these abodes, they built houses for their kings, and temples for their gods, in that massy style which most nearly resembled the sides of the caverns in which they had been reared. They descended the Nile, carrying with them arts, religion, and commerce. Elder Thebes was their colony. The Egyptians were their pupils, and perhaps their children. Under that splendid hierarchy of their priests, which had already fallen into decay when the materials for the first profane history which has reached us were collecting, the valley of the Nile became richer, not only in corn, with which it supplied the wants of its neighbors, but in temples and cities, in colossal statues, in obelisks and pyramids, than any country the sun has ever risen upon. One of its works, and that too under ground, the labyrinth, Herodotus* pronounced to have cost more labor than the pyramids, or than all the public buildings of Greece. Here architecture had a purpose, it spoke a language. Wisdom and might of the Deity were the language of the Sphinx. The obelisk, which we attempt to imitate, but dare not dream of equalling, sacred to the sun, may have been a visible representation of a ray of his light, or an imitation of the figure of flame, one of the earliest objects of adoration, and not unfitly representing the creative, preserving, and destroying power of Deity.

A similar style of architecture and sculpture was carried by the same, or a kindred race, through Syria into Persia, and Southern India, and may still be seen in the ruins of Persepolis, and in the temples of Elephantæ and Ellora. Is it not the same, too, which the genius of the Greeks has perfected, in the Doric, Ionic, and Corinthian? Is it possible that Cadmus and Cecrops, and other forgotten captains and legislators; that Thales and Pythagoras, and others who studied in Egyptian schools, should have taken, along with the letters and sciences which they carried home to Greece, no drawings of columns and statues? Is the resemblance in shape and proportions, between the reeded pillars † of Luxor and the fluted Doric, and between the lotus capital of Latopolis and the acanthus capital of Corinth, accidental?

The origin of the orders of Grecian architecture is, notwithstanding, considered uncertain. The account the Greeks themselves give of it, as we learn from Vitruvius, is deserving of at least something better than the contempt with which it is spoken of by Wilkins.‡

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* Euterpe, 148.

† The origin ascribed to the peculiar form of the Egyptian pillars is curious and probable. They are supposed to have been meant to resemble bundles of the sacred lotus, fastened together at intervals, and having the leaves bending downwards at top, forming the capital.

‡ In reference to the Egyptian origin of architecture, the ingenious Mr Wilkins, with almost marvellous inconsistency, calls that nation *contemptible*,—those fathers of the sciences and arts, whom the ancients, with singular unanimity, reverenced also for their virtues and

At some remote period, according to the Roman architect, Achaia and all the Peloponnesus were under the dominion of Dorus, a son of Hellen and the nymph Opticho. In a temple, which this prince erected in honor of Juno, in the ancient city of Argos, he had the good *fortune* to hit upon a style of building, which from him has since been called Doric. The same style was from that time adopted in the other sacred edifices erected in the cities of Achaia, although no exact proportions had yet been fixed upon to guide in their erection.

In after times, by command of the Delphian oracle, and with the common consent of all Hellas, the Athenians sent thirteen colonies into Asia, under the supreme command of Ion, an acknowledged son of Apollo. Under his guidance these colonies landed on the coast of Asia, dispossessed the native Carians and Leleges, and founded thirteen powerful cities in the fertile region, to which, in honor of their leader, they gave the name of Ionia. There they established the worship of the immortal gods, and began to erect temples. And first to Apollo Panionius, the god of all the Ionians, they erected a temple in imitation of those they had seen in Achaia, and called it Doric, from being built in the style first adopted in Dorian cities.

Desirous, however, to introduce in this building columns of new and settled proportions, which should, at the same time, be beautiful to the sight, and suited to give a firm support to the weight which rested upon them, ('ad onus ferendum essent idoneæ, et in aspectu probatam haberent venustatem,') they bethought themselves to measure the foot of a man, and compare it with his height. The proportions they transferred to the Doric column, the height of which with its capital was, from this circumstance, made six times its diameter at the base. Thus the Doric column first exhibited in architecture the proportion, firmness, and majesty of the form of man.

In the columns of a temple to Diana, they introduced the more graceful proportions of the female form. These columns were made eight diameters in height. A slight base

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their wisdom. The learned Goguet says of them, 'Aucune nation, de quelque coté qu'on l'envisage, n'a fait dans les anciens temps plus d'honneur à l'humanité.' See '*Origine des Loix, des Arts et des Sciences,*' Vol. I. p. 44.

was in imitation of the slipper; the volutes, of the curls of hair on each side of the face; the cimatia and other ornaments, of the ringlets on the forehead, and the flutings, of the folds of the robe. The proportions, Vitruvius says, were improved by the better taste of a later age; and this beautiful style of architecture, thus first adopted by the Ionian colonists, has been ever since called the Ionic order.

The Corinthian column, the lightest of the three, has the slender and nymph-like proportions, and more delicate ornaments, of the virgin age. The story of the invention of its capital has been often told. A young maiden of Corinth died. Her nurse arranged the vases, in which she had delighted while alive, in a basket, and placed it upon the top of her tomb, with a tile upon it to protect them from the weather. The basket had accidentally been set upon a root of acanthus, which, as spring drew near, threw out its leaves and shoots, and climbed up the sides of the basket. On reaching the tile on the top, they were forced outward, and made to assume the curve, which we still see in the Corinthian volutes. It chanced that Callimachus, who, from the elegance and skill with which he wrought in marble, was known among the Athenians by the name of 'the artist,' passed by, and, charmed with the gracefulness and beauty of the arrangement of the leaves, and their position on the top of the monument, adopted them as the most appropriate capital of the columns he was raising at Corinth.*

Such is the account which Vitruvius gives us of the origin and proportions of the Doric, Ionic, and Corinthian columns; and which Mr Wilkins dismisses with the easy and unauthorized declaration, that it is a dream. The story itself is not altogether improbable, and although it would be rash to vouch for, and perhaps impossible to prove, its truth, it is unphilosophical, as well as presumptuous, to reject it altogether, without giving historical or other reasons for so severe a judgment. We have too much of this hasty criticism, which pronounces whatever is of doubtful authority an *impossibility* or a *dream*. There is hardly a strange custom among unknown nations to which these hard words have not at some time been applied. The instances of Herodotus and Marco Polo are almost too notorious to be mentioned, of men, who, having been for ages, from the ignorance of their readers, disbelieved, have been found at last substantially, and often most minutely, correct.

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* We have thrown the substance of the account of Vitruvius into our own language, as the translation of Vitruvius, which is usually quoted when reference is made to this author, fails, in several important particulars, of giving correctly the full force of the original. The word *fortuito*, Mr Wilkins has not translated at all, although it is against this word that one of his sarcasms is directed. See *Wilkins's Vitruvius*, and *Liber Quartus, Caput Primum*, of the unpaged Venetian edition of the original.

Neither are the circumstances of this story entirely inconsistent with what is probably the real, remote origin of the Grecian orders. It may have been the good *fortune* of Dorus to employ an architect, who had received his education, with numbers of his countrymen, in Egypt, and who would naturally adopt a mode of building with which he had been familiar. So, indeed, might the Ionian architects, borrowing the idea of a column from the beautiful examples in Thebes and Memphis, give it the definite proportions which it wanted, and that perfection of elegance to which nothing in Egypt had attained, by the profound and poetical study of the human form, which has long been, among artists, considered the measure and the perfection of every object of art. And Callimachus may have been familiar with the capitals of Egyptian columns, and yet have borrowed a hint from some accident like that related, prompted, as he would have been, by the pride of skill, which could be so much more fully displayed upon the rich and waving leaf of the acanthus, than upon the simple outline of the lotus leaf. The history of inventions in all the arts fully shows, that it is more frequently the prerogative of genius to pursue to perfection some casual hint, than to soar at once, unassisted, into the heaven of invention. The creations of Grecian genius leave enough for the admiration of posterity, even if we do not add the merit of the first invention to that of having perfected all the arts they touched upon.

What a picture of the vigorous action of the mind, of the character of the society, and of the genius of the religion of Greece would the succeeding chapters of our history present. What illustrations it would afford the scholar, of passages or words in almost every writer, from the treasure houses in Homer to the descriptions of tombs and temples in Pausanias. In the last period of the art, it would introduce us to what may be called the poetry of architecture, the most curious and the most imposing of all the styles—the Gothic architecture, which, notwithstanding the fastidiousness of the southern taste, will long continue to command the admiration of the northern nations, with the wild songs and irregular dramas of the romantic school of poetry.

On this part of the subject, it would have been well if Dr Bigelow had been more full. There is no part of the history of the art, so little known in this country, indeed there is hardly a branch of any art so little known, as the different modes, the different eras, and the best examples of Gothic architecture ; and there is certainly none more fully deserving and more sure to reward inquiry.

The section concludes with what is called, by a well known term, the application.

'In edifices erected at the present day, the Grecian and Gothic outlines, are commonly employed to the exclusion of the rest. In choosing between them, the fancy of the builder, more than any positive rule of fitness, must direct the decision. Modern dwelling-houses have necessarily a style of their own, as far as stories and apartments, and windows and chimnies, can give them one. No more of the styles of former ages can be applied to them, than what may be called the unessential and decorative parts. In general, the Grecian style, from its right angles and straight entablatures, is more convenient and fits better with the distribution of our common edifices, than the pointed and irregular Gothic. The expense, also, is generally less, especially if anything like thorough and genuine Gothic is attempted ; a thing, however, rarely undertaken as yet, in this country. But the occasional introduction of the Gothic outline, and the partial employment of its ornaments, have undoubtedly an agreeable effect, both in public and private edifices; and we are indebted to it, among other things, for the spire, a structure exclusively Gothic, which, though often misplaced, has become an object of general approbation, and a pleasing landmark to our cities and villages.' p. 152.

We would beg leave here to suggest the want and the value of some exact information, and some wholesome suggestions, in regard to what would properly be called domestic architecture. By this we mean, plans and elevations of large and small houses, suited to the town and to the country ; plans for the arrangements of the rooms of the different stories, so as to combine, within a given space, the greatest possible amount of conveniences; some account of what constitutes the comforts and conveniences of a house; the most useful arrangements for heat and for water, for light and for air.

Nothing certainly is more wanted by the great mass of our people, than correct notions upon the modes of building cheap, convenient, and comfortable houses. Great improvements have been made within a few years, in the mode of disposing the space within the walls. But how much is still suffered from mistaken and defective plans. How much is thrown away on brick and wood, in situations where stone, a material peculiarly suited to our climate, as warmer in winter and cooler in summer than any other, would be less expensive in its first cost, and would be laid for a distant generation.

Of the plates of illustrations of this chapter, we can speak in great praise, for their selection, arrangement, and easy comprehensibility.

The valuable chapter on Heating and Ventilation is well suited to our climate, fuel, and modes of building. Of the chapter upon the Arts of Locomotion, it is sufficient to say that it gives a perfectly clear description, accompanied by many important suggestions, of the structure, form, &c. of wheels; of the best modes of attaching horses; of the different kinds of Roads, Bridges, Railroads; Canals, Tunnels, Aqueducts, Locks, Boats; form and motion of Ships; Steamboats, Diving-bell; Balloon, and other modes of passing on air, earth, and water;

ἠμὲν ἐφ’ ὑγρὴν,
Ἠδ’ ἐπ’ ἀπείρονα γαῖαν.

We were sorry not to see added to this useful mass of information, particular directions upon the making of country roads. Two points demand the attention of legislators and of all, whose business it is to superintend the *construction* of roads, namely, the form of surface best suited to secure a dry and firm way, and the angle of declivity, which will allow vehicles to go quite to the middle of the gutter on each side, without being overturned. This, for safety, ought always to be possible, where the sides are not guarded by some firm barrier.

The value of the chapter upon the Elements of Machinery is suggested by its title. Every person, who is not somewhat skilled in mechanics, should read it before he can expect to derive the greatest satisfaction from a visit to any manufacturing establishment whatever. Among other curious contrivances described in this chapter, are, that for changing velocities, by means of two cones situated with their axes parallel to each other, and their larger diameters in opposite directions; the Sun and Planet wheel of Watt; that combination of power called the Toggle Joint; the Fly Wheel, commonly supposed to have the faculty of creating force, and really acting as if it had; and that miracle of self-regulating power, which has already been spoken of, the Governor.

It is not a common fault of authors to think too well of their readers, but it is one into which most writers on this part of Mechanics have fallen. To be suited to unlearned readers, several of the descriptions should, we think, be longer and more minute. A person must have uncommon quickness of perception, to understand immediately, from the description here and usually given of the Sun and Planet wheel of Watt, why the fly wheel revolves twice while the other is revolving once, and yet a line or two of explanation would make it perfectly plain. So the principle on which a fly wheel, the *effect* of which is very accurately described, accumulates power, does not become evident, until after mature reflection upon the nature of inertia, and a more full and particular account of that property of matter than is usually given. We recommend these and some other like points to the care of the author in future editions.

There is no subject on which there is more vagueness of thought among practical men, or more inaccuracy of statement in most writers, than the subject of the next chapter, the 'Sources and Comparative Value of the Moving Forces used in the Arts.' All of them, animal strength, water, wind, steam, and gunpowder, are extremely difficult to estimate accurately by themselves, and still more so to compare with each other. Notwithstanding the many careful experiments that have been made, much still remains to be determined, and we shall look with great impatience for the conclusions arrived at, in the experiments which, we understand, have been lately undertaken in a neighboring town, by a person, who has uncommon qualifications and extraordinary facilities for experimenting. Some fixed unit of measure ought to be adopted, as Hachette many years ago endeavored to persuade mechanics, to which all forces should be referred. The unit he proposed, or the *dynamic unit*, was the force required to raise a kilogramme to the height of a metre in a given time.

The measure recommended by Mr Watt, and generally, as Dr Bigelow says, adopted, is the average power of a horse. 'The measure of a horse's power, according to Mr Watt, is, that he can raise a weight of 33,000 pounds to the height of one foot in a minute.' p. 256. Now, to say nothing of the uncertain quantity of a horse's power, and of its difference among different breeds and in different countries, what an awkward unit is 33. How much simpler to refer at once to some absolute unit, such as the force necessary to raise one or one thousand pounds one foot in one minute.

In the chapter upon the Moving Forces, we have accounts of the different kinds of water and wind mills; of the steam engine, carriage, and gun; of the useful application of gunpowder. Some fuller developement might have been given with advantage, of the three modes of action of steam; but the drawings and description of the machine are exceedingly clear and satisfactory, and taken from the latest and best authorities.

The fifteenth chapter treats of the modes and means of making ropes, carpets, cotton, woollen, and linen cloths; hats and paper, and of *spinning jennies*, *mules*, *power looms*, *double speeders;* with a word of memorial (may it prove a monument of lasting fame) to Hargreaves, Arkwright, Crompton, Moody, and others. We can only say of it, that as we found a great deal of it new ourselves, we are much inclined to think others will find it so likewise.

In the two succeeding chapters are contained descriptions of clocks, watches, and other instruments for measuring time; and of the modes of extracting, with many processes of working, the precious and useful metals. In these and the succeeding chapters, the bountiful contributions of the sciences of Mechanics and Chemistry to the arts, are exhibited, with a great mass of facts usually hidden from all eyes but those of artists and operatives, yet amply deserving the attention of every one. Three of these chapters are upon the subjects of communicating and modifying Color, by paints, dyes, and other processes; Vitrification, or the making and cutting of glass, artificial gems, and Reaumur's porcelain; and Induration by heat, or the arts of making bricks, and various kinds of pottery and porcelain, ancient and modern, from the unburnt bricks of Babylon, to the Etruscan vases.

'The use of bricks in building, may be traced to the earliest ages, and they are found among the ruins of almost every ancient nation. The walls of Babylon, some of the ancient structures of Egypt and Persia, the walls of Athens, the Rotunda of the Pantheon, the temple of Peace, and the Thermæ, at Rome, were all of brick. The earliest bricks were dried in the sun, and were never exposed to great heat, as appears from the fact that they contain reeds and straws, upon which no mark of burning is visible. These bricks owe their preservation to the extreme dryness of the climate in which they have remained, since the earth of which they are made, often crumbles to pieces when immersed in water, after having kept its shape for more than two thousand years. This is the case with some of the Babylonian bricks, with inscriptions in the arrow-headed character, which have been brought to this country. The ancients, however, at a later period, burnt their bricks, and it is these chiefly which remain at the present day. The antique bricks were larger than those employed by the moderns, and were almost universally of a square form. Besides bricks made of clay, the ancients also employed a kind of factitious stone, composed of a calcareous mortar. * ' pp. 463, 464.

The work very properly concludes with a chapter upon the Preservation of Organic Substances; and appended are twenty neatly executed plates.

A complete cabinet of apparatus, suitable to the illustration of the several subjects of the volume, would exhibit models of most of the curious engines and machines, which are employed in the useful arts, and collections of substances and instruments that would be, at the same time, useful in the departments of Chemistry and Natural Philosophy. Beautiful models of columns and other parts of buildings, and of some of the most remarkable ancient and modern edifices, may be easily imported. A common carpenter might be instructed to make wooden models of arches, domes, bridges, fireplaces, stoves, carriage wheels, water wheels, and many other parts of simple machines. A common clock of large size and the parts of a watch, would exhibit everything of greatest importance in Horology, and furnish specimens of many of the Elements of Machinery. Spinning jennies and double speeders might be found among the machinery in our manufactories, that has been superseded by the ever active ingenuity of our inventive countrymen. A working model of a steam-engine ought to be found in every place of education, for without it no one can get perfectly accurate ideas of its mode of action.

Much of what we have enumerated, may, however, be dis-

' * Some travellers have even advanced the opinion that the Pyramids of Egypt are constructed with an artificial stone.'

pensed with. The only indispensable part of the apparatus is, specimens of the *materials* used in the arts. No *description* or uncolored drawing can enable the imagination of one not familiar with colors, to conceive of a pigment of a particular shade of blue or yellow, or of Quincy sienite, or bird's eye maple. And, indeed, what more beautiful exhibition could there be to a person interested in the arts, or what more likely to create an interest in them, than a full collection of the native and foreign marbles, granites, and other stones used in building, showing their appearance when rough from the quarry, and when they have received surface and shape from the hand of the artist, and a similar collection of the various kinds of imported and indigenous woods?

At the end of each chapter Dr Bigelow has given a list of the best books upon the subjects of that chapter; and few treatises of high authority have been omitted. This adds much to the value of the work. By means of it an exceedingly valuable library might be collected; and the use of it would, in some measure, supply the want of a *catalogue raisonné* of a library already formed. We could wish there had been added the titles of some authorities, for hints or materials for lectures on domestic architecture, which we have noticed as among the *desiderata*. The Italian writers on Architecture would doubtless afford something to supply the deficiency. The second volume of the Civil Architecture of Milizia, a work which ought to be given to our language, would furnish at least abundant suggestions on the subject.

We trust it is unnecessary to add to what has been said anything to recommend Dr Bigelow's book. It ought to be in the hands of every scholar, and of every gentleman of taste or leisure, and we hope it will lead to a more general attention to the arts as objects of liberal curiosity.

Every educated person may find time, at some period of his life, to gain an intimate knowledge of some one of the useful or elegant arts, or of some branch of science or of literature. In a great majority of cases, this can be done consistently with that devotion to the peculiar studies of a profession, which is the only foundation of eminent success. A comprehensive and liberal mind will regard this occasional relaxation as a want. Instead of diminishing the vigor of its action, it will in the highest degree contribute to it. From the delights of its voluntary pursuit, it will return to the necessary duties of daily occurrence with renewed animation. Some such recreation, indeed, is essential to the health and freedom of the mind, and will give it strength for higher and more energetic action.

In the desultory habits of reading, which are now too prevalent, relaxation is sought for in an endless variety of pursuits. Few give their attention long enough to any single object, aside from their profession, to obtain the commanding knowledge of it which will enable them to enlighten others, or to acquire a strong interest in it themselves. The choice of the afternoon's conversation, or the evening's reading, is left to the accident of the last review or gazette, or the latest novel. Years and lives of leisure are thus wasted without a purpose, and without enjoyment, by men who, by giving the hours of relaxation to a single object, might easily gain such a mastery of it, as to prepare a fund of entertainment for their friends, and for themselves a delightful resource against the monotony of daily cares, and the heavier but hardly less certain oppression of disappointment.

This resource may, indeed, be found in almost any pursuit which has been illustrated by human genius, or which opens an avenue into any part of the boundless field of natural science; no matter whether it be the history of Tuscan literature or the infinitesimal calculus, the language of the Mohawks or the habits of the ant, Greek history or the history of optics; any one, pursued far enough, becomes a subject of great and constant interest. But the successful study of many of these supposes a degree of leisure, or peculiarity of taste, or conjuncture of circumstances, which it falls to the lot of few to possess. It is not so with several of the arts. A knowledge of the history and principles and some skill in the practice of painting, drawing, or sculpture, or a complete acquaintance with the theoretical principles, without the practice, of architecture, mechanics, or any other of the useful arts, might be acquired in almost any situation; and their number is such as to leave free action to every variety of taste. Let each individual of a number of gentlemen who are in the habit of meeting together to exchange thoughts, select thus, and pursue, during the leisure hours of a single year, some one favorite object, and their meetings can hardly fail to become greatly more pleasant to all, when each shall bring to the common stock something which belongs to himself alone, than they are likely to be, while, pursuing one course, their ideas and sources of information are nearly the same.

Nor is it only as contributing to the entertainment of social circles and the luxury of private study, that the apportionment we speak of is important. Without it the fine arts in this country can never be successfully cultivated and made to produce anything like the beautiful models of which the older countries in Europe are full. They have here no imperial or ducal patrons, no Juliuses or Leos, to lavish upon them the revenues of empires and of centuries; and may they never have a Pericles to appropriate the contributions of independent federal states to the ornament of a single city or a single state. The patrons of the fine arts among us are legislative or municipal assemblies, and parishes, and their organs are committees.

In this state of things our only hope for the advancement of the arts is in the cultivation of individual taste, in the gradual formation of a love for the arts, which shall render a few at least in each state and in each town so far distinguished, that it shall seem ridiculous even to a popular assembly to pass them over, in the choice of committees, in favor of the demagogues, by whom, in other concerns, they are often so willing to be led. Then only shall we cease to see public buildings curtailed of their wings, and left to support their dome as they can without them; or slender Greek pillars, of a light order, crushed beneath the weight of an enormous Gothic spire; or solemn gray walls of eternal granite enclosing the tawdry ornaments appropriate to a village assembly-room.

Wherever a pure taste in the arts exists, we see it producing its natural effects. The few instances of beautiful public buildings in our towns, can easily be referred to the influence of some single mind. It is only necessary to render, among educated men, and particularly among men of wealth and leisure, the cultivation of the fine arts more general, to make the violation of good taste in building, painting, and music, as rare as it now is common.

What has been said in regard to the cultivation of the arts, is almost equally true in regard to the exact and the natural sciences. In all there is a want of concentration of individual effort, of the apportionment of the parts of the wide domain of science to single proprietors. There should, it is true, be a union of action; but the purpose for which the cultivators of the different districts should assemble, should be to give common facilities, and to enrich themselves and each other by the exchange of their separate commodities.

The publication of Dr Bigelow's book will contribute to the diffusion of a better taste, by making known the essential principles of the arts, and thus preparing for the circulation of larger and more particular treatises. It will do it no less by laying before the young inquirers something like a map of the various regions of pleasant knowledge, at a time when the affections are unoccupied, and

> 'The world is all before them where to choose.'

Art. V. *Report of the Secretary of the Navy to the President of the United States, December* 1, 1829.

We know of no work of art, no production of human genius and human power, that in any manner rivals, or may even be named in comparison with, the sailing ship. Nor can we, in all the various modes of existence resulting from modern civilization, find any social position so strange, so unnatural, and yet so full of interest, as that which is offered by a ship of war. How singular the sensations of him who gazes for the first time upon this artificial wonder! His awe at the immense proportions of the huge machine mingle with astonishment at the celerity with which it traverses the water by the aid of its wide-spread and snowy wings,—at the ready obedience with which, at the will of a pigmy, like himself, it changes its course, advances towards the wind, retreats before it, or, entering the port, suddenly becomes still and stationary as the surrounding hills, while the clouds of canvass, which, an instant before, whitened the heavens, disappear, as if by magic, from his view. As he approaches, the awe excited by its growing size and formidable defences, keeps pace with the pleasure which he feels in finding these qualities blended with so much of symmetry and beauty. The smooth side broken only at regular intervals by the protruding cannon, the graceful curves of bow and stern, and the nice proportions of the tapering spars, as they rise in exact and Corinthian harmony, each sustained by its system of stays and rigging, in turn attract and gratify his eye.